

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow. Claims 1-12 were rejected in the Office Action. Claims 1, 3-4, 9-10, and 12 have been amended. No new matter has been added.

A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, Claims 1-12 are now pending in this application.

Claim Rejections – 35 U.S.C. § 103

On page 1 of the Office Action, the Examiner rejected Claims 1-12 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,225,004 to Hayashi ("Hayashi") in view of U.S. Patent No. 5,827,494 to Yano et al. ("Yano et al.").

The Examiner stated that:

With respect to claims 1, 10, 12, Hayashi teaches a nickel hydride battery comprising a hydrogen storage alloy as the negative electrode, an alkaline electrolyte and nickel hydroxide as the positive electrode. The nickel hydroxide powder is mixed with a cobalt hydroxide powder, a metallic cobalt powder, a zinc oxide powder and a calcium fluoride powder. Water is also added to the resultant mixture to make a paste of active material (a bulk material). See Abstract; Column 1, Lines 10-30; Column 2, Lines 35-48; Column 4, Lines 35-43; Column 5, Lines 19-25; Claims 1-3.

However, the Examiner acknowledged that "Hayashi does not teach the inclusion of an aluminum compound in the positive electrode." The Examiner stated that (with emphasis added):

Yano et al. teach a nickel hydride battery having a positive electrode of nickel hydroxide. The surface of the hydroxide is

covered with a mixed crystal of cobalt hydroxide and a hydroxide of at least one metal (M) selected from the group consisting of aluminum, magnesium, indium and zinc. The aluminum hydroxide can become soluble in the electrolyte upon charging. The coating on the nickel hydroxide can maintain a long charge-discharge cycle and increase the conductivity of the electrode. See Abstract, Column 3, Lines 8-20.

The Examiner concluded that:

Therefore, it would have been obvious to one of ordinary skill in the art to coat the positive electrode active material with aluminum hydroxide (which is soluble in the electrolyte) in the battery of Hayashi, because Yano et al. teach the use of aluminum hydroxide coating on the nickel hydroxide to improve the performance of the electrochemical cell. A method of forming an active positive electrode containing aluminum hydroxide in a battery is also taught.

Hayashi is directed to a “nickel positive electrode for alkaline storage batteries and method for producing the same.” Yano et al. is directed to a “process for producing non-sintered nickel electrode for alkaline battery” and discloses “nickel hydroxide or its solid solution covered with a mixed crystal” that contains “cobalt hydroxide and a hydroxide of at least one metal (M) selected from the group consisting of magnesium, zinc, aluminum and indium” (column 3, lines 41-46 and column 3, line 64 to column 4, line 1).

The “Ni/metal hydride secondary element” recited in independent Claims 1, 9, and 10 and the “method of forming an active positive electrode” recited in independent Claim 12 would not have been obvious in view of Hayashi, alone or in any proper combination with Yano et al. under 35 U.S.C. § 103(a).

1. Claims 1-8

Claim 1 (as amended) is in independent form and recites a “Ni/metal hydride secondary element” comprising, in combination with other elements, a “positive electrode . . . formed by a bulk material mixture comprising nickel hydroxide, cobalt oxide, and an aluminum compound soluble in the electrolyte, wherein the aluminum compound is provided

as a coating of $\text{Al}(\text{OH})_3$ on the surface of at least one of the positive electrode and the nickel hydroxide.”

Hayashi, alone or in any proper combination with Yano et al., does not disclose, teach or suggest a “Ni/metal hydride secondary element” comprising, in combination with other elements, a “positive electrode . . . formed by a bulk material mixture comprising nickel hydroxide, cobalt oxide, and an aluminum compound soluble in the electrolyte, wherein the aluminum compound is provided as a coating of $\text{Al}(\text{OH})_3$ on the surface of at least one of the positive electrode and the nickel hydroxide.”

As noted by the Examiner, “Hayashi does not teach the inclusion of an aluminum compound in the positive electrode.” Accordingly, Hayashi does not teach or suggest a bulk material mixture” that comprises “an aluminum compound” or that the “aluminum compound is provided as a coating of $\text{Al}(\text{OH})_3$ on the surface of at least one of the positive electrode and the nickel hydroxide.”

Yano et al. also does not teach or suggest a “bulk material mixture” that comprises “an aluminum compound” or that the “aluminum compound is provided as a coating of $\text{Al}(\text{OH})_3$ on the surface of at least one of the positive electrode and the nickel hydroxide.” In contrast, Yano et al. teaches a “nickel hydroxide or its solid solution covered with a mixed crystal” that contains “cobalt hydroxide and a hydroxide of at least one metal (M) selected from the group consisting of magnesium, zinc, aluminum and indium” (column 3, lines 41-46 and column 3, line 64 to column 4, line 1). While the present Claim 1 (as amended) recites a “mixture” of the various bulk material constituents, Yano et al. teaches a “mixed crystal.” One example of a difference between the “mixture” recited in Claim 1 and the “mixed crystal” (i.e., a “doped” compound) taught by Yano et al. is described in the present Application (with emphasis added):

[0022] In the case of such aluminum-doped nickel hydroxides, the aluminum incorporated in the cell occurs in the host lattice of the nickel hydroxide and replaces the nickel lattice positions. It thus changes the structural, chemical and electrochemical characteristics of the nickel hydroxide, which is not the case when an aluminum compound is added according to the

invention to the positive bulk material. Furthermore, when aluminum-doped nickel hydroxides are used, the aluminum is not dissolved, or can be dissolved only with extreme difficulty, by the electrolyte from the nickel aluminum hydroxide mixed crystal.

[0023] In sharp contrast, the aluminum incorporated according to the invention can be dissolved in the electrolyte. Solubility in the electrolyte is the precondition for the aluminum in the form of its oxide to be distributed by means of a dissolving/deposition processes such that the surface of the positive electrode and/or of the nickel hydroxide particle is modified by a thin, porous, and/or ion-conductive film of $\text{Al}(\text{OH})_3$ being precipitated on the positive electrode and/or on the nickel hydroxide grain.

To transform the nickel positive electrode for alkaline storage of Hayashi and the process for producing non-sintered nickel electrode for alkaline battery of Yano et al. into a “Ni/metal hydride secondary element” as recited in independent Claim 1 would require still further modification, and such modification is taught only by the Applicants’ own disclosure.

The “Ni/metal hydride secondary element” recited in independent Claim 1 (as amended), considered as a whole, would not have been obvious in view of Hayashi and Yano et al. under 35 U.S.C. § 103(a). The rejection of Claim 1 over Hayashi in view of Yano et al. under 35 U.S.C. § 103(a) is improper. Therefore, Claim 1 is patentable over Hayashi in view of Yano et al. Dependent Claims 2-8, which depend from independent Claim 1, are also patentable. See 35 U.S.C. § 112 ¶ 4.

2. Claim 9

Claim 9 (as amended) is in independent form and recites a “Ni/metal hydride secondary element” comprising, in combination with other elements, a “positive electrode . . . formed by a bulk material comprising a mixture of nickel hydroxide, cobalt oxide, and an aluminum compound selected from the group consisting of aluminum oxide and aluminum hydroxide in powder form.”

Hayashi, alone or in any proper combination with Yano et al., does not disclose, teach or suggest a “Ni/metal hydride secondary element” comprising, in combination with other

elements, a “positive electrode . . . formed by a bulk material comprising a mixture of nickel hydroxide, cobalt oxide, and an aluminum compound selected from the group consisting of aluminum oxide and aluminum hydroxide in powder form.”

As noted by the Examiner and described above, “Hayashi does not teach the inclusion of an aluminum compound in the positive electrode.” Yano et al. also does not teach or suggest a “positive electrode . . . formed by a bulk material comprising a mixture of nickel hydroxide, cobalt oxide, and an aluminum compound selected from the group consisting of aluminum oxide and aluminum hydroxide in powder form.” In contrast, Yano et al. teaches a “nickel hydroxide or its solid solution covered with a mixed crystal” that contains “cobalt hydroxide and a hydroxide of at least one metal (M) selected from the group consisting of magnesium, zinc, aluminum and indium” (column 3, lines 41-46 and column 3, line 64 to column 4, line 1).

To transform the nickel positive electrode for alkaline storage of Hayashi and the process for producing non-sintered nickel electrode for alkaline battery of Yano et al. into a “Ni/metal hydride secondary element” as recited in independent Claim 9 would require still further modification, and such modification is taught only by the Applicants’ own disclosure.

The “Ni/metal hydride secondary element” recited in independent Claim 9 (as amended), considered as a whole, would not have been obvious in view of Hayashi and Yano et al. under 35 U.S.C. § 103(a). The rejection of Claim 9 over Hayashi in view of Yano et al. under 35 U.S.C. § 103(a) is improper. Therefore, Claim 9 is patentable over Hayashi in view of Yano et al.

3. Claims 10-11

Claim 10 (as amended) is in independent form and recites a “Ni/metal hydride secondary element” comprising, in combination with other elements, a “positive electrode . . . formed by a bulk material in a three-dimensional metallic conductive structure, the positive electrode comprising within said bulk material an aluminum compound soluble in the electrolyte, nickel hydroxide and cobalt oxide, such that upon charging the element, the

aluminum compound dissolves into the electrolyte and forms a thin, porous and/or ion-conductive film of Al(OH)₃ on surface portions of the positive electrode.”

Hayashi, alone or in any proper combination with Yano et al., does not disclose, teach or suggest a “Ni/metal hydride secondary element” comprising, in combination with other elements, a “positive electrode . . . formed by a bulk material in a three-dimensional metallic conductive structure, the positive electrode comprising within said bulk material an aluminum compound soluble in the electrolyte, nickel hydroxide and cobalt oxide, such that upon charging the element, the aluminum compound dissolves into the electrolyte and forms a thin, porous and/or ion-conductive film of Al(OH)₃ on surface portions of the positive electrode.”

As noted by the Examiner and described above, “Hayashi does not teach the inclusion of an aluminum compound in the positive electrode.” Yano et al. also does not teach or suggest a “bulk material” that results in the formation of a “thin, porous and/or ion-conductive film of Al(OH)₃ on surface portions of the positive electrode.” In contrast, Yano et al. teaches a “nickel hydroxide or its solid solution covered with a mixed crystal” that contains “cobalt hydroxide and a hydroxide of at least one metal (M) selected from the group consisting of magnesium, zinc, aluminum and indium” (column 3, lines 41-46 and column 3, line 64 to column 4, line 1). Thus, Yano et al. does not teach or suggest a “thin, porous, and/or ion conductive film of Al(OH)₃ on surface portions of the positive electrode,” as recited in independent Claim 10 (as amended).

To transform the nickel positive electrode for alkaline storage of Hayashi and the process for producing non-sintered nickel electrode for alkaline battery of Yano et al. into a “Ni/metal hydride secondary element” as recited in independent Claim 10 would require still further modification, and such modification is taught only by the Applicants’ own disclosure.

The “Ni/metal hydride secondary element” recited in independent Claim 10 (as amended), considered as a whole, would not have been obvious in view of Hayashi and Yano et al. under 35 U.S.C. § 103(a). The rejection of Claim 10 over Hayashi in view of Yano et al. under 35 U.S.C. § 103(a) is improper. Therefore, Claim 10 is patentable over Hayashi in

view of Yano et al. Dependent Claim 11, which depends from independent Claim 10, is also patentable. See 35 U.S.C. § 112 ¶ 4.

4 Claim 12

Claim 12 (as amended) is in independent form and recites a “method of forming an active positive electrode” comprising, in combination with other elements, “mixing nickel hydroxide, cobalt, and a powder of an aluminum compound to form a bulk material” and “forming a thin, porous and/or ion-conductive film of $\text{Al}(\text{OH})_3$ on the surface portions, thereby activating the positive electrode.”

Hayashi, alone or in any proper combination with Yano et al., does not disclose, teach or suggest a “method of forming an active positive electrode” comprising, in combination with other elements, “mixing nickel hydroxide, cobalt, and a powder of an aluminum compound to form a bulk material” and “forming a thin, porous and/or ion-conductive film of $\text{Al}(\text{OH})_3$ on the surface portions, thereby activating the positive electrode.”

As noted by the Examiner and described above, “Hayashi does not teach the inclusion of an aluminum compound in the positive electrode.” Yano et al. also does not teach or suggest “mixing nickel hydroxide, cobalt, and a powder of an aluminum compound to form a bulk material” and “forming a thin, porous and/or ion-conductive film of $\text{Al}(\text{OH})_3$ on the surface portions, thereby activating the positive electrode.” In contrast, Yano et al. teaches a “nickel hydroxide or its solid solution covered with a mixed crystal” that contains “cobalt hydroxide and a hydroxide of at least one metal (M) selected from the group consisting of magnesium, zinc, aluminum and indium” (column 3, lines 41-46 and column 3, line 64 to column 4, line 1).

To transform the nickel positive electrode for alkaline storage of Hayashi and the process for producing non-sintered nickel electrode for alkaline battery of Yano et al. into a “method of forming an active positive electrode” as recited in independent Claim 12 would require still further modification, and such modification is taught only by the Applicants’ own disclosure.

The "method of forming an active positive electrode" recited in independent Claim 12 (as amended), considered as a whole, would not have been obvious in view of Hayashi and Yano et al. under 35 U.S.C. § 103(a). The rejection of Claim 12 over Hayashi in view of Yano et al. under 35 U.S.C. § 103(a) is improper. Therefore, Claim 12 is patentable over Hayashi in view of Yano et al.

* * *

It is submitted that each outstanding objection and rejection to the Application has been overcome, and that the Application is in a condition for allowance. Claims 1-12 will be pending in this Application. The Applicant requests reconsideration and allowance of all pending Claims 1-12.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 06-1447.

Respectfully submitted,

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By 

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5564
Facsimile: (414) 297-4900

Marcus W. Sprow
Attorney for Applicant
Registration No. 48,580